

College Herbarium (MONT); University of Tennessee Herbarium (TENN); and the U. S. National Museum, Smithsonian Institution (US).

LITERATURE CITED

- CRÉPIN, F. 1900. Note upon a probable hybrid of *Rosa carolina* L. and *Rosa nitida* Willd. *RHODORA* 2: 112–113.
- ERLANSON, E. W. 1934. Experimental data for the revision of the North American wild roses. *Bot. Gaz.* 96: 197–259.
- FLORY, W. S., JR. 1950. Pollen conditions in some species and hybrids of *Rosa* with a consideration of associated phylogenetic factors. *Va. Journ. Sci.* 1 (N.S.): 11–59.
- LEWIS, W. H. 1957a. Revision of the genus *Rosa* in eastern North America: A review. *Am. Rose Ann.* 42: 116–126.
- . 1957b. A monograph of the genus *Rosa* in North America. I. *Rosa acicularis*. *Brittonia* (in press).
- LYNES, D. 1955. A double-flowered *Rosa carolina*. *Baileya* 3: 58.
- NAKAI, T. 1916. Praecursores ad floram sylvaticam Coreanam. VII. *Bot. Mag. Tokyo* 30: 217–242.
- RAFINESQUE, C. S. 1820. Prodrome d'une monographie des rosiers de l'Amérique septentrionale. *Ann. Gen. Sci. Phys.* 5: 209–220.
- RYDBERG, P. A. 1918. *North American Flora* 22: part 6.

NOTES ON NEARCTIC HEPATICAE VI. PHYTO-
GEOGRAPHICAL RELATIONSHIPS OF CRITICAL
SPECIES IN MINNESOTA AND ADJACENT
AREAS OF THE GREAT LAKES

R. M. SCHUSTER

(Concluded from p. 234)

(7) APPALACHIAN SPECIES OCCURRING NORTHWARD TO THE LAKE SUPERIOR
REGION AND NEAR OR IN THE DRIFTLESS AREA

A number of species show this distribution pattern, *Diplophyllum apiculatum* (Fig. 13) and *Mannia rupestris* (Fig. 17) being perhaps typical. In both cases the population occurring near Lake Superior is somewhat disjunct, and represents the outlying population. A comparison of the distribution of the Appalachian endemic, *Diplophyllum apiculatum*, with that of another species of presumably Appalachian origin, *Tsuga canadensis*, is not without validity. The occurrence of such species of temperate occurrence around the shore of Lake Superior (and to the south in and near the Driftless Area), strongly suggests that the bulk of the distribution of these species is restricted to nonglaciated areas, with the restricted range around Lake Superior due to post-Pleistocene migration northward from a Pleistocene refugium in the Driftless Area. This thesis will be examined in more detail in the summation.

DIPLOPHYLLUM APICULATUM (Evs.) Steph. (Fig. 13). This common, essentially Appalachian species occurs from southern Maine to the southern edge of the Appalachian upland, south to northern Alabama and Mississippi (unpublished collections of the writer), and recurs westward sporadically to the Ozarks. It has evidently been able to push north from the glacial boundary to only a slight degree, and has been equally unable to invade the Atlantic Coastal Plain. The range is not unlike that of *Asplenium cryptolepis* (see Fernald, 1935, Map 5).

An old report from Quebec needs verification and seems unlikely. The report of the species from the coast of Hudson Bay (Wynne and Steere, 1943) is, in the light of our present knowledge, almost certainly erroneous.

The few stations in the Lake Superior area (one each in Wisconsin and Michigan), and that at Taylor's Falls, Minn., just north of the Driftless Area, are possibly derived from a population which originated in the Driftless Area. It is perhaps not entirely fortuitous that the northwestern range of *Tsuga canadensis* closely parallels the range of the *Diplophyllum*.⁹

MANNIA RUPESTRIS (Balb.) Frye and Clark (Fig. 17). This species, unlike the preceding, is strongly restricted to calcareous rocks. It occurs in the unglaciated Appalachian Plateau and in the Ozarks, apparently in the few places where calcareous rocks occur, and from central New York (Schuster, 1949) and southern Ohio south to Tennessee, and to Linville Caverns, North Carolina. It is frequent in, and at the periphery of, the Driftless Area, in Illinois, Iowa, Wisconsin and Minnesota. Two stations occur on the Lake Superior margin in Michigan. Additional isolated stations occur in the Gaspé, in Vermont, and in Ontario. However, the only points at which the species occurs with any abundance are in and near the "Driftless Area," and north of the unglaciated plateau.

As is quite evident from map (Fig. 17), the post-Pleistocene range of this species must be regarded as derived, by limited northeastward dispersal, from Pleistocene and probably pre-Pleistocene centers in the Driftless Area, and in the unglaciated Appalachian Plateau. The rarity in the latter appears chiefly a result of the very localized occurrence of suitable, moist and calcareous sites in this region. This distribution pattern should be compared with that of *Frullania bolanderi* (Fig. 12) since it gives us a partial model for an explanation of the eastern post-Pleistocene range of that species. The same general northeastward, and never northwestward, post-Pleistocene "drift" is observable. This is easily understandable on the basis of the mesophytic nature of the

⁹ The preceding discussion of *Diplophyllum apiculatum* was written three years before the species was actually found in the Driftless Area. In June, 1957, the species was found to be abundant on damp, sandstone rocks, associated with *Lycopodium selago* var. *patens*, at Rocky Arbor Roadside Park, northwest of Wisconsin Dells, Juneau Co. To one who had never previously collected in the Driftless Area, the consociation of species there was very suggestive: the Hepaticae included only species with a wide range in medium to high elevations in the Southern Appalachian System, among them *Lophozia silvicola*, *L. incisa*, *Tritomaria exsecta* and *exsectiformis*, *Lepidozia reptans*, *Calypogeia neesiana* s. str., *Geocalyx graveolens*, and such mosses as *Diphyscium sessile*. The entire hepatic flora thus gave the distinct impression of species which are widespread at higher elevations in the Blue Ridge system, as well as northward.

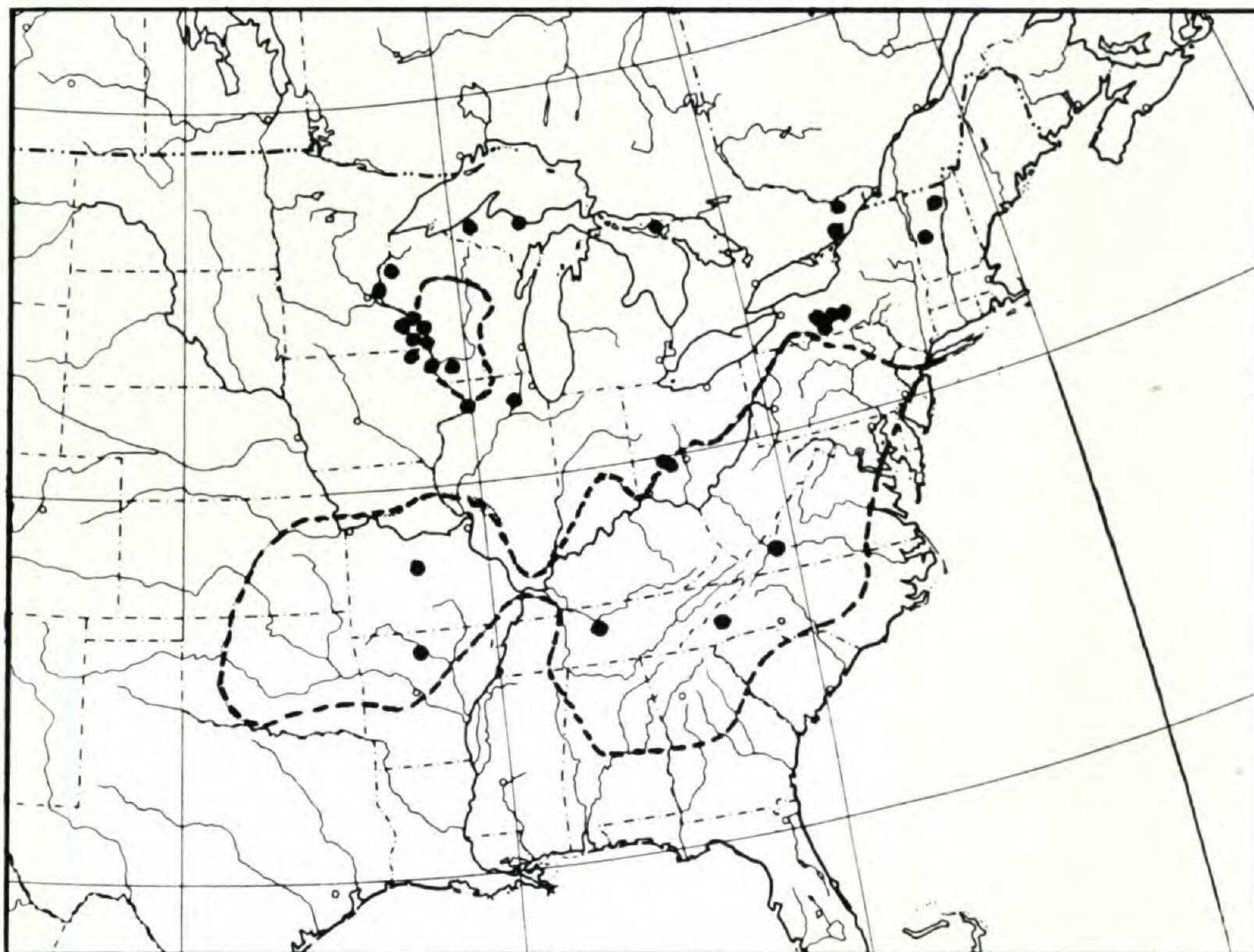


Fig. 17. North American range of *Mannia rupestris*. Within the dotted line the Ozarkian-Appalachian region that has not been submerged nor glaciated since the Paleozoic, and the Driftless Area.

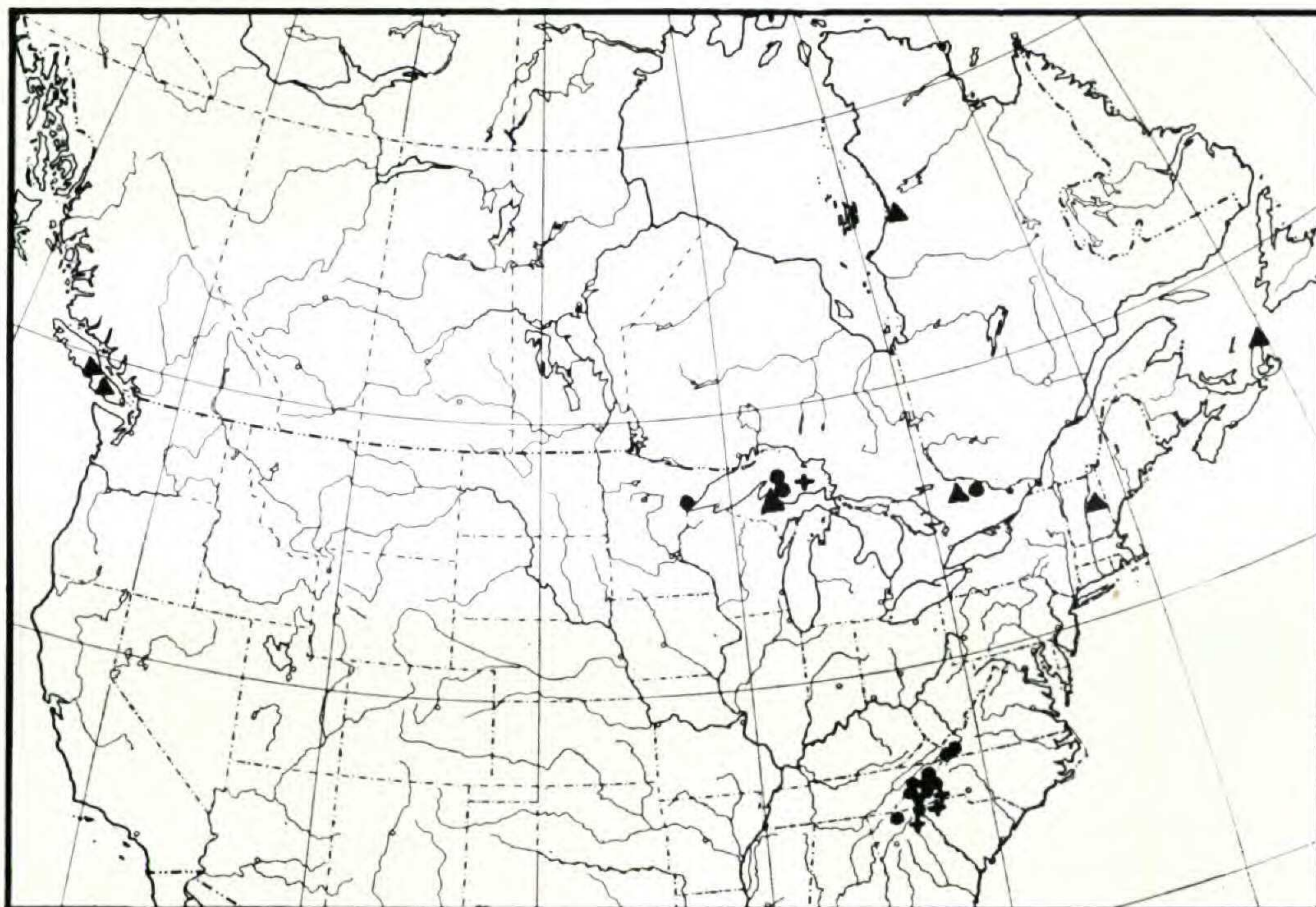


Fig. 18. Range of *Marsupella paroica* (dots), *M. sparsifolia* (triangles) and *Solenostoma appalachianum* (plus marks). Not all Appalachian stations of the latter drawn in; for its distribution see the text.

Hepaticae involved, and of the post-Pleistocene extension of the prairie, and prairie habitats, eastward.

MARSUPELLA PAROICA Schuster (Fig. 18). This very recently distinguished species (Schuster, 1957) is locally common in a small area from Brasstown Bald, Georgia, northward to Mt. Rogers and Whitetop Mt., Virginia (see Schuster & Patterson, 1957). The plant had been confused with both *M. emarginata* and *M. sparsifolia* (see Schuster, 1953, where reasons are given why it cannot go into *M. emarginata*). Disjunct stations occur in Minnesota and in the Huron Mts. of Michigan; the former station has been previously reported as *M. sparsifolia*, an essentially arctic-alpine species (triangles on map, Fig. 18); the latter served as the basis of the report of *M. emarginata* from Michigan.

The Lake Superior stations of *M. paroica* are hardly explicable except on the basis of post-glacial dispersal northward from an unglaciated area. Since the species is evidently an old endemic of the unglaciated Appalachian plateau, the Lake Superior stations must be derived either from this latter center or from a Pleistocene refugium in the Driftless Area. The latter explanation appears more reasonable on the basis of the relative distances involved.

SOLENOSTOMA APPALACHIANUM Schuster (Fig. 18, crosses). This species appears to show a very definite affinity to *Solenostoma monticola* (Hattori) comb. n.¹⁰ and is perhaps to be regarded as a vicariad of this Japanese species. Its relationships are discussed in Schuster (1958a). The original collections of *S. appalachianum* were made by the writer in 1953-54 in two localities: Neddie Creek, a small tributary of the Tuckaseegee R., Jackson Co., North Carolina, and near the Whitewater R., east of Jocassee, Oconee Co., South Carolina. In 1957 two further collections were made. In June the plant was collected, with capsules, at Pictured Rocks, Alger Co., Michigan, just above the shore of Lake Superior, and in July-August in the upper reaches of the Whitewater Gorge, in Jackson Co., near Beech Gap in Haywood Co., and in Cullasaja Gorge, Macon Co., North Carolina; subsequent collections were made in the Chattooga R., in both North and South Carolina, and in n.e. Georgia; the plant also was found in Big Creek, in n.e. Georgia. It is noteworthy that the Appalachian stations all lie in the "coves," where the old Mixed Mesophytic Forest, or derivatives of it occur.

The distribution of this species closely follows the same pattern as that of *Marsupella paroica*, except for a generally lower altitudinal range. It is perhaps significant that this species, like *M. paroica*, is a pioneer on non-calcareous rocks, therefore could have readily survived the Pleistocene glaciation on the damp, non-calcareous sandstone ledges and walls of the Driftless Area. Habitats very similar to those in which the species grows at Pictured Rocks have been found several times in the Wisconsin Dells area.

¹⁰ *Jungermannia monticola* Hattori, Bull. Tokyo Sci. Mus. 11: 33, 1944.

DISCUSSION AND SUMMARY

It is always tempting to generalize from distribution patterns which show unusual features. By a process of conscious or unconscious selection it is also often possible to misplace emphasis, or to derive unwarranted conclusions. Added to this are the additional dangers imposed by a fragmentary knowledge of the range of the species (the well-known "distribution of collectors" phenomenon), leading to erroneous conclusions, as, for example that of Steere (1937) with respect to some of the so-called "Cordilleran" relicts of the Lake Superior regions. In spite of these dangers, study of the present ranges of plants remains a fascinating, but somewhat hazardous occupation. Since practically all of the extant generalizations, valid and invalid, with respect to the distribution of temperate and boreal North American plants are derived from study of the ranges of the Tracheophytes, the present contribution may serve to add significantly to the available evidence. As has been pointed out, the small size of the *Hepaticae*, which is surely related to their ability to survive in microhabitats, together with their great genetic stability (partly a consequence of their high incidence of vegetative reproduction) makes them an ideal group from the point of view of phytogeographical studies.

Admitting the hazards involved in generalizing from a limited number of selected species, the following tentative conclusions appear warranted. (1) There is a distinct, if somewhat tenuous, connection between the "old" flora of the unglaciated Appalachians and that of the Driftless Area (Fig. 13, 17). Perhaps through the latter there is an even more tenuous connection with the flora of Lake Superior, presumably the consequence of recent migration from a Pleistocene refugium in the Driftless Area (Figs. 13, 18). (2) There is a definite floristic connection between the Driftless Area and Lake Superior. *Frullania bolanderi* (Fig. 12) and *Mannia pilosa* (Fig. 16) serve to demonstrate this connection, and the range of the latter appears to establish a connection between the Lake Superior flora and that of the Arctic. Parallelisms in the Angiosperms and Pteridophytes are not unknown. (3) There appears to be a striking, if tenuous, connection between the flora of the Driftless Area and the Arctic, as demonstrated by *Athalamia hyalina* (Fig. 15). A close parallel

has been pointed out in the Angiosperms by Rosendahl (1947), in *Chrysosplenium iowense* Rydb., occurring peripheral to the Driftless Area in n.e. Iowa, again in Alberta, and in the high North American Arctic. (4) A pronounced connection between the Driftless Area, the Great Lakes region, and the far western flora is evidenced by the distribution of *Frullania bolanderi* (Fig. 12). The distribution of the herbaceous angiosperm, *Mertensia paniculata*, is suggestively similar.

The preceding cases, each involving the Driftless Area, are as a whole suggestive. Of these, the most meaningful perhaps is that of the corticolous species, *Frullania bolanderi* (Fig. 12). In this case, at least, the distribution in the east impinges only on one area where the species could have survived the Pleistocene glaciation, in other words, the Driftless Area. Thus there appears to be demonstrated a distinct connection between the flora bordering the Lake Superior region, and the much warmer Driftless Area. Among the Angiosperms, such cases, although rare, are also known (*Mertensia paniculata*, *Abies balsamea*, *Potentilla tridentata*, *Primula mistassinica*, *Populus balsamea*, *Thuja occidentalis*, etc.). Added to this is the fact that there are occasional species, of temperate and largely Appalachian, or Appalachian-Ozarkian range, which have attained the southern edge of the Lake Superior area, and occur in, or near, the Driftless area as well (Figs. 13, 17, 18). From this the conclusion can hardly be avoided that, in some fashion or another, the Driftless Area has served as a refugium for some of the plants, otherwise unknown from the Midwest, which have in post-Pleistocene times invaded the Great Lakes Area. In this connection, one must consider the range of the largely Cordilleran *Mertensia paniculata*, known from stations in northeastern Iowa, and southeastern Minnesota; the range of *Primula mistassinica*, known i.e., from a station in the unglaciated portion of Illinois; and the range of *Potentilla tridentata*, known i.e., from a station in southeastern Minnesota at the periphery of the Driftless Area, in Houston Co. All three species are common around Lake Superior. Additional examples appear unnecessary.¹¹ By this the writer would not try to deduce

¹¹ There are also a host of "relicts" found in the glaciated Mississippi River-St. Croix River valley region, running northward from the Driftless Area towards the Lake Superior region. Among them are *Primula mistassinica* (near Stillwater, Minn.), *Streptopus roseus* var. *longipes* (Fern.) Fassett (Taylors Falls, Wisc.), *Dryopteris fragrans* var. *remotiuscula* Komarov (St.

a wholesale revegetation of the Great Lakes Area, from a hypothetical refugium in the Driftless region. However, it is probable, from the range of such arctic-alpine species as *Athalamia hyalina*, *Mannia sibirica* and *pilosa*, and of such Cordilleran species as *Asterella saccata*, that such "rigid" species, of relict distribution regionally, were forced this far southward during the time of the Pleistocene glaciation. That they were not, in all cases, able to migrate northward recently to the Lake Superior region (as, for instance, in the case of *Asterella saccata* and *Athalamia hyalina*) does not materially alter this fact. The only other explanation, that the ranges of these species in the "Driftless Area" are the result of chance post-Pleistocene migrations would imply too fortuitous a series of coincidences to warrant serious consideration. The writer would therefore suggest a serious re-appraisal of Fernald's (1925) hypothesis that the Driftless Area served as a possible refugium, from which some of the disjunct Great Lakes vegetation could have been derived. The argument against this by Fassett (1931) based in part on the fact that the Cordilleran-Lake Superior *Rubus parviflorus* does not occur in the Driftless Area is not insurmountable, especially in view of the fact that another of the Cordilleran-Lake Superior species (*Mertensia paniculata*) does still survive in n.e. Iowa at the borders of the Driftless Area. The absence of specific species from the "Driftless Area," which are, however, characteristic of the Lake Superior region, proves nothing.¹²

In the case of the larger herbs, or shrubs (such as the *Rubus*), and of trees, which are exposed to the macroenvironment, survival in the Driftless Area, especially during the thermal maximum, is scarcely to be expected. Smaller herbs (such as *Mertensia*) or even more likely, small cryptogamic plants (such as *Hepaticae*),

Croix Falls, Wisc.), *Lycopodium selago* var. *patens* (Beauv.) Desv. (Minnesota R. near Mankato and near St. Paul, Minn.), *Scirpus caespitosus* var. *callosus* Bigel. (Scott Co. and Ramsey Co., Minn., in and near the Minnesota R. valley). The occurrence of these plants as relicts in the region between the Lake Superior shore (where they are common pioneer or near-pioneer plants), and the Driftless Area (where they are now unknown, except for the *Primula*), suggests that they may be the rear-guard of a considerably larger series of species which at one time may have migrated northward from the Driftless Area to the shores of Lake Superior. The inverse explanation: that they are recent migrants, southward from the Lake Superior shore region, appears highly improbable.

¹² Deevey (1949, p. 1391) warned specifically against this type of negative reasoning, stating: "There is probably no field of scholarly activity where it is so dangerous, and at the same time so tempting, to reason from negative evidence, as biogeography."

which can survive in restricted microenvironments appear more able to withstand major climatic changes, and appear to have survived in the Driftless Area in larger numbers. This concept receives some indirect support from the fact that the *Hepaticae* with arctic and/or Lake Superior affinity and/or Cordilleran affinity (*Mannia sibirica*, *M. pilosa*, *Athalamia hyalina*, *Asterella saccata*) are all members of the order *Marchantiales*, suborder *Marchantiinae*. The *Marchantiales*, of all the *Hepaticae*, are the only ones with a well-developed xeromorphic structure, adapted to long unbroken periods without available water. This is to be considered in the light of the fact that of the 175 species of *Hepaticae* found in Minnesota, less than 10% belong to the suborder *Marchantiinae*. Yet no arctic-alpine members of the Lake Superior flora, belonging to the other, less xeromorphic groups, occur today in the Driftless Area. Considering some of the above distributional anomalies, which have received far from satisfactory explanations, the earlier suggestion of Fernald (1925) becomes more plausible than his more recent (1935) hypothesis that a "nunatak" area at the head of Lake Superior served as a refugium during glacial times.

The above interpretation of the role of the Driftless Area in the vegetation of the western Great Lakes Area is also supported by other recent sources which have not been drawn on in the foregoing discussion. For example, Braun (1950, p. 522-523) states that "The development of the Beech-Maple Forest [of the "Glaciated North"] was not the result of uninterrupted migrations from south of the Wisconsin glacial border. The aspect of mixed forest communities of ravine slopes, and the nature of the soil of the Driftless Area and adjacent very old drifts to the west suggest that this hilly area may have been a Pleistocene refugium for an attenuated mixed mesophytic forest which was isolated hereabouts in late Tertiary time, or at latest, in pre-Wisconsin time. From this refugium, early post-Pleistocene migration took place. This is indicated by the early appearance of *Fagus* and *Tilia* in records of nearby bogs. . . ." Miss Braun concludes, therefore, that "Thus two migrations, one from the south and one from the Driftless Area, met to the north of the Prairie Peninsula," leading to the present distribution of the Beech-Maple forest. Implied in this is a much further westward oc-

currence of Beech during the “mid-postglacial humid, warm period” with subsequent curtailment of its range during the subsequent xerothermic period. During this period, also, a large variety of the larger shrubs that may have survived in the Driftless Area, such as *Rubus parviflorus*, may have suffered extinction in the Driftless. According to this interpretation of Braun, “The Maple-Basswood Forest is . . . at least in part postglacial in origin. It appears to have been derived by climatic modification of the late Tertiary or interglacial forest of the Driftless Area. . . .” Such an interpretation of postglacial migration outward of various vegetational elements has also been used to explain the existing range of various other species. Thus McLaughlin (1931, p. 286) has suggested that *Hypericum kalmianum*, a slender shrub up to 6 dm. high, endemic to the Great Lakes, survived the Pleistocene in the Driftless Area, migrating eastward during the early postglacial period along the margins of the glacial lakes. A similar explanation could also be advanced for the distribution of the very distinctive Great Lakes endemic, *Cirsium pitcheri*, which today is confined to the shores of Lakes Michigan, Huron and Superior.

The above conclusions, with respect to the role played by the Driftless Area in the revegetation of the Lake Superior region, stand directly opposed to those recently expressed by Abbe (in Butters & Abbe, 1953, p. 69). Abbe, indeed, goes so far as to consider the presumed migration of species from the Driftless Area northward to the North Shore of Lake Superior as requiring “far more in the way of botanical legerdemain” than the migration patterns he postulates. However, it must be emphasized that Abbe dealt with only the Tracheophytes, and largely with the Angiosperms. The presence in the Driftless Area of arctic and “Cordilleran” elements, as regards the Angiosperms, has been known for a long time (the case of *Rhododendron lapponicum*) and has been confirmed by recent work [Rosendahl (1947) *Chrysosplenium iowense* and *Sedum rosea*; Williams (1937) *Mertensia paniculata*]. This lends credence to the idea (Fernald, 1925) that the Driftless Area played some part as a source of some of the local populations of otherwise arctic and Cordilleran species now occurring around Lake Superior, and in the area to the north of it.

Abbe (loc.cit., p. 70), reviews the evidence against considering the north shore of Lake Superior, or the Keweenaw Peninsula, as "refugia." With this evidence, there is no valid basis for argument. However, Abbe also discards the idea of Fernald (1925) that some of the relict species (and specifically the "Cordilleran" ones) could have survived in the Driftless Area, and migrated in the post-glacial period to their disjunct stations in the Great Lakes. He states: "It becomes necessary, if a nunatak theory is to be maintained as a philosophical necessity, either to relegate such refugia to still unexplored areas or to retreat southward to the Driftless Area. Either procedure demands that the rarities of today migrate across a terrain already heavily mantled by vegetation. It is far more reasonable to recognize the limitations of these species which restrict them to migration under the more favorable conditions for dissemination found in a periglacial zone . . . or along the strand and shore rocks and cliffs of the glacial lakes." Such an explanation, undoubtedly, holds for the majority of widespread plants today found around the shores of the Great Lakes. However, a question remains as to whether it applies to the so-called "rigid" species (*sensu* Hultén), whose ability to compete and migrate actively appears to be exceptionally low or to such forest species as *Frullania bolanderi*. The majority of the so-called disjuncts, or "critical" species, are, to a greater or lesser extent, rigid species, as was emphasized by Fernald. It is in these cases, where it is difficult to visualize fluctuating and migrating populations rapidly extending their range in an east-west or west-east direction, where the closely adjacent Driftless Area may acquire some significance as a "refugium."

The preceding discussion leaves unanswered the question of why there is such a marked disjunct element of arctic species around the shores of Lake Superior. The first 15 examples cited (Figs. 1-10) can be materially supplemented, and represent only a portion of the arctic and arctic-alpine species of *Bryophyta* known from the Lake Superior region. The paper by Steere (1937) lists a series of equally interesting disjunct arctic mosses and that by Thomson (1954) an impressive list of arctic and "high arctic" lichens. This arctic flora can be very simply explained as a relict or "old" flora, left behind during the immediate post-glacial

period, in a locally favorable area. The high incidence of arctic species around Lake Superior, and the much lower incidence of them in the rest of the Great Lakes Region supports this simple explanation. Lake Superior, the deepest of the lakes, is also by far the coldest, with the slightest winter-summer fluctuation in temperature. As a consequence, a narrow, permanently treeless, barren border exists, extending inward for only a few score yards (and often to a much lesser extent), and up for 10–50 feet in elevation above the Lake (rarely much higher), whose existence depends on the cooling effect of Lake Superior. This narrow strip has been presumed to represent a microclimatically (and, because of wave-action, in some cases a microedaphically) controlled Tundra strip (Schuster, 1953). The vegetation of this strip, involving the *Hepaticae* outlined (species 1–15), together with a series not discussed (*Lophozia kunzeana*, *L. hatcheri*, *L. groenlandica*, *L. grandiretis*, *L. alpestris*, *Tritomaria quinquedentata*, *Solenostoma sphaerocarpum*, *Tritomaria scitula*, *Lophozia lycopodioides*, *L. obtusa*, and others; for their regional distribution, see Schuster, 1953) compares favorably with that of the coastal portion of southern and central Greenland, as delineated by Bøcher (1933) and of coastal Ellesmere Island (Bryhn, 1906–1907; Schuster, unpublished). The same rock-pool community, formed by *Scirpus caespitosus*, accompanied by *Polygonum viviparum*, *Potentilla tridentata*, *Pinguicula vulgaris*, characterizes some of the coastal portions of Greenland.¹³

It is therefore postulated that the disjunct species around the shore of Lake Superior may belong to two types (1) a series of “rigid” species, which may have survived the Pleistocene glaciation in the Driftless Area, and migrated northward the short distance involved to the Lake Superior shore, probably in the immediate postglacial period, and (2) a series of widespread arctic species, not found in the Driftless Area, which represent relicts of the immediate post-glacial period, when the Lake Superior area was invaded by a tundra-type of vegetation. The species of the first class persist in cool, moist microclimates, in many cases, in the Driftless Area, *in spite of the much warmer and*

¹³ This affinity is even more strongly suggested by the fact that *Lophozia latifolia* Schuster (see Schuster 1953, 1954) known previously only from this arctic strip along the Lake Superior shore in Minnesota, has recently turned up in collections studied from Thule, Greenland, as well as in material from Swedish Lapland, from Alaska, and from northeastern Ellesmere Island.

drier general environmental conditions currently obtaining there. The species of the second class today persist around the Lake Superior shore because of the persistence there of localized tundra conditions in the vicinity of the spray zone of the lake.—DEPARTMENT OF BOTANY, UNIVERSITY OF MASSACHUSETTS, AMHERST, MASS.

LITERATURE CITED

- AMAKAWA, T. AND S. HATTORI. 1955. A Revision of the Japanese Species of the Scapaniaceae. III. Jour. Hattori Bot. Lab. No. 14: 71-90, figs. XV-XX.
- ARNELL, S. 1950. *Scapania degenii* and *S. simmonsii* found on the North American Continent. The Bryol. 53: 299-300.
- BÖCHER, T. W. 1933. Studies on the Vegetation of the East Coast of Greenland. Meddel. om Grønland 104 (4): 1-132.
- BRAUN, E. LUCY. 1950. Deciduous forests of eastern North America. Blakiston, Phila.
- BRYHN, N. 1906-1907. Bryophyta in Itinere Polari Norvagogorum Secundo Collecta. Report of the 2nd Norwegian Arctic Exped. in the "Fram" 1898-1902, 2(11): 1-260, pls. 1-2.
- BUCH, H. 1928. Die Scapanien Nord-Europas und Sibiriens—2. Systematischer Teil. Soc. Sci. Fennica, Comm. Biol. 3(1): 1-177, figs. 1-39 and map.
- BUCH, H., A. W. EVANS, AND F. VERDOORN. 1938. A Preliminary Check List of the Hepaticae of Europe and America (North of Mexico). Ann. Bryol. 10 (1937): 3-8.
- BUCH, H. AND R. TUOMIKOSKI. 1955. Contribution to the Hepatic Flora of Newfoundland. Arch. Soc. "Vanamo" 9, Suppl.: 3-29, maps 1-4.
- BUTTERS, F. K. AND E. C. ABBE. 1953. A floristic study of Cook County, northeastern Minnesota. RHODORA 55: 21-55, 63-101, 116-154, 161-201.
- CLARK, L. AND T. C. FRYE. 1942. Some Hepaticae of Alaska. The Bryol. 45: 63-71.
- DEEVEY, E. S. 1949. Biogeography of the Pleistocene. Bull. Geol. Soc. Amer. 60: 1315-1416.
- EVANS, A. W. 1915. Notes on North American Hepaticae, VI. The Bryol. 18: 81-91.
- FASSETT, N. C. 1931. Notes from the herbarium of the University of Wisconsin—VII. RHODORA 33: 224-228.
- FERNALD, M. L. 1925. Persistence of Plants in Unglaciaded Areas of Boreal America. Mem. Amer. Acad. 15: 241-342.
- . 1935. Critical Plants of the Upper Great Lakes Region of Ontario and Michigan. RHODORA 37: 197-222, et sequel. 238-262, 272-301, 324-341, Pl. 352-379.
- . 1950. Gray's Manual of Botany, Ed. 8. American Book Co.

- FRYE, T. C. AND L. CLARK. 1937-1947. Hepaticae of North America. Univ. of Wash. Publ. in Biol. 6 (1-5): 1-1018.
- HULTÉN, E. 1937. Outline of the history of the arctic and boreal biota during the Quaternary period. Stockholm.
- LEPAGE, E. 1945. The lichen and bryophyte flora from James Bay up to Lake Mistassini. The Bryol. 48: 171-186.
- . 1953. Materials for a better knowledge of the Hepatic Flora of Northern Quebec. The Bryol. 56: 101-115.
- MCLAUGHLIN, W. T. 1931. Preliminary Reports on the Flora of Wisconsin, XIV. Hypericaceae. Trans. Wisc. Acad. Sci., Arts & Letters 26: 281-288.
- MÜLLER, K. 1951-1954. Die Lebermoose Europas. Rabenhorst's Kryptogamen-Flora 3rd Ed. 6(1): i-xii, 1-756, figs. 1-247.
- PERSSON, H. 1946. Some Alaskan and Yukon Bryophytes. The Bryol. 49: 41-58.
- . 1952. Critical and otherwise interesting bryophytes from Alaska-Yukon. The Bryol. 55: 1-25.
- REIMERS, H. 1940. Geographische Verbreitung der Moose im südlichen Harzvorland. Hedwigia 79: 175-373, 21 figs.
- ROSENDAHL, C. O. 1947. Studies in *Chryso-splenium*, with special reference to the taxonomic status and distribution of *C. iowense*. RHODORA 49: 25-36, pls. 1053-1054.
- SCHUSTER, RUDOLF M. 1949. The ecology and distribution of Hepaticae in central and western New York. The Amer. Midl. Nat. 42(3): 513-712, figs. 1-13, pls. 1-18.
- . 1951. Notes on Nearctic Hepaticae, II. The Hepaticae of the East Coast of Hudson Bay. Bull. 122, Canadian Ntl. Museum: 1-62, Pls. I-VIII.
- . 1951a. *Ibid.*, IV. *Scapania spitzbergensis* and *Scapania convexula* in North America. The Bryol. 54(3): 162-180, figs. A-B, Map 1.
- . 1953. Boreal Hepaticae, A Manual of the Liverworts of Minnesota and Adjacent Regions. The Amer. Midl. Nat. 49(2): i-v, 257-684, Figs. 1-16, Pls. 1-110.
- . 1954. Notes on Nearctic Hepaticae, VII. *Lophozia (Dilophozia) latifolia* sp. nov. The Bryol. 56: 257-276, pls. I-II.
- . 1957. Notes on Nearctic Hepaticae, XII. *Marsupella paroica* sp. nov. The Bryol. 60: 145-151.
- . 1957a. Notes on Nearctic Hepaticae, XV. *Herberta*. Rev. Bryol. et Lichen. 26: 123-145.
- . 1958. Boreal Hepaticae, III. Phytogeography. The Amer. Midl. Nat. 59: 257-332.
- . 1958a. Notes on Nearctic Hepaticae, XV. Two new species of *Solenostoma* with notes on the classification of the genus. The Bryol. 61 (in press).
- AND P. M. PATTERSON. 1957. Noteworthy Hepaticae from Virginia. RHODORA 59: 251-259.

- STEERE, W. C. 1937. Critical Bryophytes from the Keweenaw Peninsula, Michigan. *RHODORA* 39: 1-14, 33-46, 6 figs.
- SUZA, J. VON. (1938) 1940. Denkwürdige Lebermoose des xerothermen Gebietes in der Tschecho-Slowakei. *Acta Bot. Bohemica* 12: 1-68, 1 pl.
- THOMSON, JOHN W. 1954. Lichens of the 1951 foray to the north shore of Lake Superior. *The Bryol.* 57: 278-291.
- WITTLAKE, E. B. 1954. The Hepaticae of Arkansas. I. *The Bryol.* 57: 7-18.
- WILLIAMS, L. O. 1937. A Monograph of the Genus *Mertensia*. *Ann. Mo. Bot. Garden* 24(1): 1-159.
- WYNNE, F. E. AND W. C. STEERE. 1943. The Bryophyte Flora of the East Coast of Hudson Bay. *The Bryol.* 46: 73-87.

A NEW SPECIES OF VICIA (LEGUMINOSAE)
IN FLORIDA¹

R. K. GODFREY AND ROBERT KRAL

Vicia ocalensis Godfrey & Kral, sp. nov.—Perennis, caulibus ad 12 dm. altis, crebris et inter se multum innectentibus, prostratis vel suberectis. Caulibus ramisque insignite striatis, sparse pilosis. Foliis 4-6 foliolatis, plerumque 6. Foliolis 3-5 cm. longis 3-6 mm. latis, subtus sparse pilosis supra granularibus, linearibus vel anguste lineari-oblongis aut lineari-ellipticis, apicibus rotundo-mucronatis. Racemibus axillaribus, longi-pedunculatis, ferentibus ad 18 flores. Floribus 10-12 mm. longis. Pediculis calycibusque pilosis, lobis late deltoidis brevi-acuminatis. Petalis albis, quorum cacumina suffunduntur colore pallido-caeruleo ipsa lamina plus minusve suffusa omnino colore pallido-caeruleo. Leguminibus sparse brevi-pilosis aut glabratis, 4-4.5 cm. longis 6-8 mm. latis, ferentibus ad 8-12 semina.

SPECIMENS EXAMINED: **Florida.** Marion Co.: Juniper Creek bank, Ocala National Forest, May 18, 1949, *Mather m-270* (FLAS); prostrate to climbing, succulent-leaved, blue-flowered plants, common on moist sands along creek through sandhills, toward east-central boundary of Ocala National Forest, April 7, 1957, *Kral 4569* (FSU); forming a dense entangled mat in roadside ditch bordering hammock, along Juniper Springs Creek, northeast of Juniper Springs, May 3, 1957, *Godfrey 55537* (FSU—Type).

Vicia ocalensis is apparently closely related to two other native *Vicia* species of the southeastern United States, *V. acutifolia* Elliott and *V. floridana* S. Watson. It is readily distinguished from both of the latter by its much more robust stature, its

¹ Financial support contributing to this research was made available to the senior author by a grant from the National Science Foundation (G-2010). Funds for graduate student assistance were furnished by the Research Council, Florida State University. These aids are gratefully acknowledged.